



2017-18

## 5.7 Exponential & Logarithmic Models

Name \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

Use the simple interest formula to answer the following. ( $I = Prt$ )

1. What is the interest due if \$500 is borrowed for 6 months at a simple interest rate of 6% per annum?
2. If you borrow \$5,000 and, after 9 months pay off the loan in the amount of \$5,500, what per annum rate of interest was charged?
3. The total amount borrowed on a loan is called the \_\_\_\_\_.
4. In working problems involving interest, if the payment period of the interest is quarterly, the interest is paid \_\_\_\_\_ times a year.

**Find the amount that results from each investment. Round answers to the nearest cent.**

5. \$100 invested at 4% compounded quarterly after a period of 2 years.
6. \$1000 invested at 11% compounded continuously after a period of 2 years.

**Find the principal needed now to get each amount; that is, find the present value. Round answers to the nearest cent.**

7. To get \$100 after 2 years at 6% compounded monthly

8. To get \$300 after 4 years at 3% compounded daily

**Find the effective rate of interest.**

9. For 5% compounded continuously

10. What rate of interest compounded annually is required to double an investment in 3 years?

11. What rate of interest compounded annually is required to triple an investment in 10 years?

### **Applications**

12. If Tanisha has \$100 to invest at 8% per annum compounded monthly, how long will it be before she has \$150? If the compounding is continuous, how long will it be?

13. A department store charges 1.25% per month on the unpaid balance for customers with charge accounts (interest is compounded monthly). A customer charges \$200 and does not pay off her bill for 6 months. What is the bill at that time?

14. John requires \$3000 in 6 months to pay off a loan that has no prepayment privileges. If he has the \$3000 now, how much of it should he save in an account paying 3% compounded monthly so that in 6 months he will have exactly \$3000?

15. Jim places \$1000 in a bank account that pays 5.6% compounded continuously. After 1 year, will he have enough money to buy a computer system that costs \$1060? If another bank will pay Jim 5.9% compounded monthly, is this a better deal?

### **Growth & Decay Applications**

16. The size  $P$  of a certain insect population at time  $t$  (in days) obeys the function  $P(t) = 500e^{0.02t}$ .

a) Determine the number of insects at  $t = 0$  days.

b) What is the growth rate of the insect population?

c) What is the population after 10 days?

d) When will the population reach 800?

e) When will the insect population double?

17. Strontium 90 is a radioactive material that decays according to the function  $A(t) = A_0 e^{-0.0244t}$ , where  $A_0$  is the initial amount present and  $A$  is the amount present at time  $t$  (in years). Assume that a scientist has a sample of 500 grams of strontium 90.

- a) What is the decay rate of strontium 90?
- b) How much strontium 90 is left after 10 years?
- c) When will 400 grams of strontium 90 be left?
- d) What is the half-life of strontium 90?

18. The population of a colony of mosquitos obeys the law of inhibited growth.

- a) If  $N$  is the population of the colony and  $t$  is the time in days, express  $N$  as a function of  $t$ .
- b) If there are 1000 mosquitoes initially and there are 1800 after day 1, what is the size of the colony after 3 days?
- c) How long is it until there are 10,000 mosquitoes?

19. The population of a southern city follows the exponential law.

a) If  $N$  is the population of the city and  $t$  is the time in years, express  $N$  as a function of  $t$ .

b) If the population doubled in size over an 18-month period and the current population is 10,000, what will the population be 2 years from now?

20. The population of a Midwestern city follows the exponential law.

a) If  $N$  is the population of the city and  $t$  is the time in years, express  $N$  as a function of  $t$ .

b) If the population decreased from 900,000 to 800,000 from 2008 to 2010, what will the population be in 2012?

21. The half-life of radioactive potassium is 1.3 billion years. If 10 grams is present now, how much will be present in 100 years? In 1000 years?

22. A fossilized leaf contains 70% of its normal amount of carbon 14. How old is the fossil? (The half-life of carbon 14 is 5600 years.)